Calculating Critical Values of t-Distributions Using Tables of Percentage Points

Refer to: Table of Percentage Points of the t Distribution, p. 3 of this document.

Two-Tailed Critical Values of the t[72]-Distribution

Two-tailed 5 percent critical values of the t[72] distribution: $\alpha = 0.05 \Rightarrow \alpha/2 = 0.025$.

- Locate column of table headed **0.025** ← **area in one tail** of t-distribution
  0.05 ← **area in two tails** of t-distribution

  $t_{0.025}[72]$ lies between $t_{0.025}[60] = 2.000$ and $t_{0.025}[120] = 1.980$.

  $t_{0.025}[72]$ can be approximated using the following linear interpolation formula:

$$t_{0.025}[72] \cong 2.000 - (2.000 - 1.980)\frac{72 - 60}{120 - 60} = 2.000 - 0.02\frac{12}{60} = 2.000 - 0.004 = 1.996$$

- ***Result:***
  - ***Upper* $\alpha/2 = 0.025$ critical value of t[72] distribution = $t_{0.025}[72] = 1.996$**;
  - ***Lower* $\alpha/2 = 0.025$ critical value of t[72] distribution = $-t_{0.025}[72] = -1.996$**.
- Stata ***invttail(df, α/2)*** function: **display invttail(72, 0.025)** returns the value 1.994.

Two-tailed 1 percent critical values of the t[72] distribution: $\alpha = 0.01 \Rightarrow \alpha/2 = 0.005$.

- Locate column of table headed **0.005** ← **area in one tail** of t-distribution
  0.010 ← **area in two tails** of t-distribution

  $t_{0.005}[72]$ lies between $t_{0.005}[60] = 2.660$ and $t_{0.005}[120] = 2.617$.

  $t_{0.005}[72]$ can be approximated using the following linear interpolation formula:

$$t_{0.005}[72] \cong 2.660 - (2.660 - 2.617)\frac{72 - 60}{120 - 60} = 2.660 - 0.043\frac{12}{60} = 2.660 - 0.0086 = 2.651$$

- ***Result:***
  - ***Upper* $\alpha/2 = 0.005$ critical value of t[72] distribution = $t_{0.005}[72] = 2.651$**;
  - ***Lower* $\alpha/2 = 0.005$ critical value of t[72] distribution = $-t_{0.005}[72] = -2.651$**.
- Stata ***invttail(df, α/2)*** function: **display invttail(72, 0.005)** returns the value 2.646.

<u>One-Tailed</u> Critical Values of the t[72]-Distribution

One-tailed 5 percent critical value of the t[72] distribution: $\alpha = 0.05$.

- Locate column of table headed **0.05** ← **area in <u>one</u> tail** of t-distribution
  0.10 ← **area in <u>two</u> tails** of t-distribution

  $t_{0.05}[72]$ lies between $t_{0.05}[60] = 1.671$ and $t_{0.05}[120] = 1.658$.

  $t_{0.05}[72]$ can be approximated using the following linear interpolation formula:

$$t_{0.05}[72] \cong 1.671 - (1.671 - 1.658)\frac{72-60}{120-60} = 1.671 - 0.013\frac{12}{60} = 1.671 - 0.0026 = 1.668$$

- ***Result:***
  - For a ***right tail*** **test**, $\alpha = 0.05$ critical value of t[72] distribution = $\mathbf{t_{0.05}[72] = 1.668}$;
  - For a ***left tail*** **test**, $\alpha = 0.05$ critical value of t[72] distribution = $\mathbf{-t_{0.05}[72] = -1.668}$.
- Stata ***invttail(df, α)*** function: **display invttail(72, 0.05)** returns the value 1.666.

One-tailed 1 percent critical value of the t[72] distribution: $\alpha = 0.01$.

- Locate column of table headed **0.01** ← **area in <u>one</u> tail** of t-distribution
  0.02 ← **area in <u>two</u> tails** of t-distribution

  $t_{0.01}[72]$ lies between $t_{0.01}[60] = 2.390$ and $t_{0.01}[120] = 2.358$.

  $t_{0.01}[72]$ can be approximated using the following linear interpolation formula:

$$t_{0.005}[72] \cong 2.390 - (2.390 - 2.358)\frac{72-60}{120-60} = 2.390 - 0.032\frac{12}{60} = 2.390 - 0.0064 = 2.384$$

- ***Result:***
  - For a ***right tail*** **test**, $\alpha = 0.01$ critical value of t[72] distribution = $\mathbf{t_{0.01}[72] = 2.384}$;
  - For a ***left tail*** **test**, $\alpha = 0.01$ critical value of t[72] distribution = $\mathbf{-t_{0.01}[72] = -2.384}$.
- Stata ***invttail(df, α)*** function: **display invttail(72, 0.01)** returns the value 2.379.

Table of Percentage Points of the t Distribution

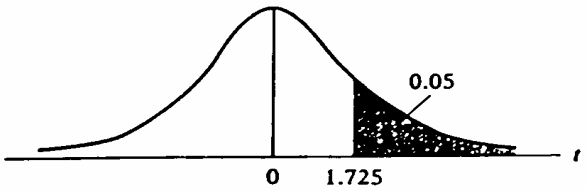
TABLE D.2
Percentage points of the *t* distribution

Example

$\Pr(t > 2.086) = 0.025$

$\Pr(t > 1.725) = 0.05$ for df = 20

$\Pr(|t| > 1.725) = 0.10$



df \ Pr	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.05	0.01 0.02	0.005 0.010	0.001 0.002
1	1.000	3.078	6.314	12.706	31.821	63.657	318.31
2	0.816	1.886	2.920	4.303	6.965	9.925	22.327
3	0.765	1.638	2.353	3.182	4.541	5.841	10.214
4	0.741	1.533	2.132	2.776	3.747	4.604	7.173
5	0.727	1.476	2.015	2.571	3.365	4.032	5.893
6	0.718	1.440	1.943	2.447	3.143	3.707	5.208
7	0.711	1.415	1.895	2.365	2.998	3.499	4.785
8	0.706	1.397	1.860	2.306	2.896	3.355	4.501
9	0.703	1.383	1.833	2.262	2.821	3.250	4.297
10	0.700	1.372	1.812	2.228	2.764	3.169	4.144
11	0.697	1.363	1.796	2.201	2.718	3.106	4.025
12	0.695	1.356	1.782	2.179	2.681	3.055	3.930
13	0.694	1.350	1.771	2.160	2.650	3.012	3.852
14	0.692	1.345	1.761	2.145	2.624	2.977	3.787
15	0.691	1.341	1.753	2.131	2.602	2.947	3.733
16	0.690	1.337	1.746	2.120	2.583	2.921	3.686
17	0.689	1.333	1.740	2.110	2.567	2.898	3.646
18	0.688	1.330	1.734	2.101	2.552	2.878	3.610
19	0.688	1.328	1.729	2.093	2.539	2.861	3.579
20	0.687	1.325	1.725	2.086	2.528	2.845	3.552
21	0.686	1.323	1.721	2.080	2.518	2.831	3.527
22	0.686	1.321	1.717	2.074	2.508	2.819	3.505
23	0.685	1.319	1.714	2.069	2.500	2.807	3.485
24	0.685	1.318	1.711	2.064	2.492	2.797	3.467
25	0.684	1.316	1.708	2.060	2.485	2.787	3.450
26	0.684	1.315	1.706	2.056	2.479	2.779	3.435
27	0.684	1.314	1.703	2.052	2.473	2.771	3.421
28	0.683	1.313	1.701	2.048	2.467	2.763	3.408
29	0.683	1.311	1.699	2.045	2.462	2.756	3.396
30	0.683	1.310	1.697	2.042	2.457	2.750	3.385
40	0.681	1.303	1.684	2.021	2.423	2.704	3.307
60	0.679	1.296	1.671	2.000	2.390	2.660	3.232
120	0.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	0.674	1.282	1.645	1.960	2.326	2.576	3.090

Note: The smaller probability shown at the head of each column is the area in one tail; the larger probability is the area in both tails.

Source: From E. S. Pearson and H. O. Hartley, eds., *Biometrika Tables for Statisticians*, vol. 1, 3d ed., table 12. Cambridge University Press, New York, 1966. Reproduced by permission of the editors and trustees of *Biometrika*.

Source: Damodar N. Gujarati, *Basic Econometrics*, Third Edition. New York: McGraw-Hill, 1995, p. 809.